USDA/NASA Workshop
Breakout Synthesis Report

Focus Area: **Water Management and Conservation**

Focus Area Moderator: John Werner

Synthesis Team:

Number of Breakout Groups: 3

Total Participants:

Part 1 – Requirements Definition
Part 2 – Research & Data Relevance
Part 3 – Gap Identification
Part 4 – Collaborative Opportunities

Question 1 Requirements Definition

What are USDA's policy and program needs that might be fulfilled with earth science and remotely sensed information?

(1) Water availability and prediction tools
   a. Snowmelt runoff
   b. Soil Moisture Surface and Root Zone
   c. Evapotranspiration
   d. Precipitation
   e. Groundwater monitoring
   f. Streamflow
   g. Modeling and Data assimilation

(2) Water Quality Assessment
   a. Nutrients
   b. Sediments, soil loss and turbidity
   c. Biological productivity including harmful algal blooms
   d. Water temperature
   e. Other pollutants
   f. Modeling and Data assimilation

(3) Water resources management impact assessments
   a. Land use/cover changes (appropriate scale)
   b. Hydrological changes in association with urbanization
   c. Stream bank and geomorphology
   d. Wetland and inundated riparian areas
   e. Improved soil characterization and digital elevation maps
   f. Modeling and Data assimilation

Question 2 Research and Data Relevance

What is the state of the research (USDA and NASA) and current NASA measurement and modeling capabilities that are relevant to these needs?

(1) Water Availability and Prediction Tools

a. Most of our tools are based on point observations for e.g.

-Water supply forecasting is based on point values from SNOTEL (automated snow observation system)

-Drought assessment is based on point values from SCAN (automated soil moisture and temperature observation system)

b. Most modeling is based on point data rather than geospatial data.

-Hydrological Models (few examples)

SWAT
EPIC
TR-55
TR-20
AGNPS
KINEROS
HEC-RAS

-Water Supply Models/River Forecasting Models (few examples)

SRM
PMRS
SAC-SMA

c. Examples of geospatial data from satellite-based sensors include (but are not limited to) and modeling capabilities

-AMSR	Snow, soil moisture
-ASTER	Surface temperature
-ICESAT	ice sheet, water level altimetry
-LANDSAT	long-term data stream
-MODIS	Land cover, snow cover
-TRMM	Precipitation
-GRACE	Total water storage
-HYPERION	hyper-spectral
-LDAS	Hydrological variables

(2) Water Quality Assessment

a. Point sampling is still status quo. Most are manual monitoring systems although a few automated systems exist.

b. Sediments and phytoplanktons can be measured at a 1km scale in coastal areas; e.g. MODIS

c. Systems range from hand-held to aircraft mounted to satellite sensors with varying spatial resolutions (generally decreasing).

d. Processing capabilities include ENVI, ERDAS and other systems

(3) Water resources management impact assessments

a. Altimetry, lasers, radar and LANDSAT

b. DEMs are available
c. DSS are available that use spatial data sets.

Question 3 Gap Identification

What are the gaps in existing knowledge and research pertaining to the ability of earth science to address the USDA needs?

(1) Water availability and prediction tools
   a. Optimize spatial, temporal scales using specific spectral bands to improve accuracy
   b. More efficient data management and availability, in formats that enhance inter-operability
   c. Implementation and development of models that are able to handle spatially explicit and large data sets
(2) Water Quality Assessment
   a. Optimize spatial, temporal and spectral characteristics for future satellite systems
   b. More efficient data management and availability, in formats that enhance inter-operability
   c. Most models are unable to handle spatially explicit and large data sets
   d. Identify spectral signatures of nutrients and other pollutants
   e. Lack of accepted standards for measurement of water quality utilizing remote sensing
(3) Water resources management impact assessments
   a. Optimize spatial, temporal scales to improve accuracy
   b. More efficient data management and availability, in formats that enhance inter-operability
   c. Most models are unable to handle spatially explicit and large data sets
   d. Lack of technical collaboration between resource managers and research scientists

Question 4 Collaborative Opportunities

What are the opportunities for collaborative/cooperative R&D efforts between USDA and NASA to develop products and solutions to serve decision makers?

(1) Water availability and prediction tools
   a. Launching of HYDROS
   b. Data mining and packaging for decision support systems for internet-based distribution capability
   c. Opportunity to merge USDA research with NASA/NOAA climate forecasting efforts
   d. Expand SCAN and conduct more field validation programs
   e. Produce soil moisture products at “1km” or less spatial resolution
   f. Develop enhanced sensor capabilities that have optimized spatial, temporal and spectral characteristics and improved accuracy

(2) Water Quality Assessment
   a. Data mining and packaging for decision support systems for internet-based distribution capability
   b. Move sediment and phytoplankton measurement techniques in SeaWIFS, MODIS and AISA from ocean/coastal to inland areas.
   c. Explore utility of sub-orbital platforms and optimize sampling and scale (temporal and spatial) of detection
   d. Develop regionally adaptive type of process to better understand impact of management
   e. Development of technical standards for water quality assessment using remote platforms
   f. Develop enhanced sensor capabilities that have optimized spatial, temporal and spectral characteristics and improved accuracy

(3) Water resources management impact assessments
   a. Data mining and packaging for decision support systems for internet-based distribution capability
   b. Formation of partnerships between resource managers and research scientists to define product/assessment tools

(4) Formation of long-term partnership through a NASA-USDA MOU/working group for future research and application activities
   a. Joint research call for answering NASA-USDA needs
   b. Coordination of NASA modeling capabilities with corresponding USDA efforts
   c. Cooperation in training efforts and technology transfer between NASA and USDA on joint needs

How can improvements in these areas help in improving in the operational missions for USDA and other agencies?